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THE ENTOMOLOGY OF A POND.

By E. A. BUTLER.

ABOVE THE SURFACE (*continued*).

THREE different families of flies contribute to the dancing swarms mentioned in our last paper, the *Culicidæ*, or gnats proper, the *Chironomidæ*, or midges, and the *Tipulidæ*, which includes the winter gnats and daddy-longlegs. But those of the last family are not aquatic in early life; the genus *Trichocera*, which belongs to this family, furnishes the so-called gnats that sally forth in swarms during bright sunshine in the winter months. The swarming of these is dependent upon the weather, for it has been observed by the Rev. A. E. Eaton that their style of flight varies with the temperature. A cold below 36° Fahr. puts a stop to their aërial excursions altogether, and drives them to their places of retreat under boards, &c.; at temperatures a little above this they will venture forth singly, but when 45° Fahr. is reached they are then able to congregate in multitudes and dance for joy. But, though thus forming swarms, and so resembling the gnats proper, they differ from them, as above-mentioned, in not being aquatic. We must not suppose, therefore, that all gnat-like creatures—nor, indeed, all that fly in swarms—have spent the early part of their life in the water, and it is only with such as have done so that we are now concerned—viz., the *Culicidæ*, or gnats, and the *Chironomidæ*, or midges.

A great amount of human suffering often follows from causes apparently the most insignificant, and no better illustration of this can be found than is afforded by the insects we have first to consider—the *Culicidæ*, or gnats and mosquitoes, the latter being included because, though not truly British insects, they are closely allied to our own familiar gnats. If, in the absence of personal knowledge, one were to endeavour to conjecture the probable form of one of these little pests, from the agonising tales of the persecutions to which humanity is subjected by them, the imagination would naturally conjure up a formidable figure, with "danger" emblazoned, as it were, in its very aspect; but the reality is vastly different from any such conjecture, and it is almost impossible to believe that so frail, so insignificant a creature as these really are can inflict such torments. The *Culicidæ*, as a family, are indeed answerable for a vast amount of human suffering; and while it is true that our share of it in this country is comparatively trifling, yet even here they not unfrequently cause considerable annoyance. They form one of the most widely distributed families of insects; not only do they swarm in the tropics and temperate regions, but even the cold of Arctic snows is not sufficient to check their multiplication and exterminate their race.

Let us now endeavour to draw the portrait of a gnat, and be it remembered that what is here said of a gnat is applicable in almost every respect to the mosquito as well.

First, a gnat is a Dipterous insect, that is, it is possessed of only a single pair of wings, that corresponding to the front pair in other insects; but though there are no hind wings as such, the missing organs are not wholly unrepresented, but their place is taken by a pair of exquisitely delicate knobbed stalks, like tiny clubs, which have been called, indifferently, "halteres," "balancers," "poisers," from a notion that they aided the insect in maintaining its equilibrium in its aërial journeys. In all the long-legged, slender-bodied division of the flies, these peculiar organs are particularly conspicuous, and no better example could be obtained for studying their peculiarities than an ordinary daddy-longlegs (Fig. 1), one of the largest representatives

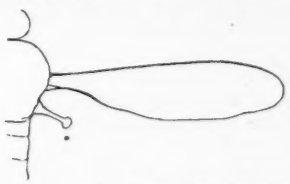


Fig. 1.—Forewing and "Balancer" of Daddy-Longlegs.

of the section. It is very difficult to say what is their exact function, if, indeed, they have not more than one. Some have supposed them to be organs of hearing, others, of respiration; but after all that has been said on the subject, their exact use still remains problematical. The upper pair of wings are long, narrow, membranous, and clear, though in some species prettily spotted. Attached to the nervures are some tiny scales similar to those on a butterfly's wing, and others of kindred nature form a clothing for the body. Each scale is really composed of an extremely delicate double membrane, strengthened on each side with longitudinal ridges, those of the opposite sides uniting at the broad end of the scale, where they form a series of points projecting beyond the membrane itself. The legs are long, and extremely slender, and easily part company with the body. The head of the male carries a pair of exquisite antennæ, in the form of plumes, somewhat as one might imagine Liliputian ostrich feathers to be; those of his spouse are much simpler organs, with very short lateral appendages.

The terrible weapon that renders these insects so annoying, consists of the organs of the mouth; but before we can understand them properly, it will be necessary to refer to the general plan of an insect's eating apparatus, for notwithstanding the many and mighty differences in this part of its organisation, shown in the various orders of insects, they are all modifications of one type of structure. Imagine, then, an aperture bounded above by a transversely placed organ, the *labrum*, or upper lip, and below by a pair of organs, usually more or less coalesced into a single one, the *labium*, or lower lip. Between these two, and bounding the sides of the aperture place first, and nearest the labrum, a pair of organs so articulated as to be capable of lateral motion only, the *mandibles*, and

secondly, below these, another pair, also capable of lateral motion, the *maxillæ*. Add finally a pair of jointed appendages attached to the base of the *maxillæ*, and another pair to the labium (which is essentially a second pair of maxillæ), the *maxillary* and *labial palpi*, and you have the main parts of that complicated mechanism with which insects have to take their food. Many of these parts are often modified to an extreme degree, and more or less deprived of their power of motion, and some may be altogether suppressed; still, a careful examination will usually enable the above plan to be more or less easily recognised.

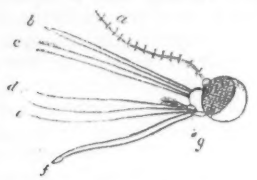


Fig. 2.—Head of Female Gnat, much magnified. *a*, Antenna; *b* labrum; *c*, mandibles; *d*, maxillæ; *e*, lingua; *f*, labium; *g*, maxillary palpus.

Now, in our gnat (Fig. 2) the labrum is transformed into a stout bristle, and the labium elongated to an extraordinary degree, forming a sort of sheath, open above and sheltering in its trough both mandibles and maxillæ; the whole apparatus forms a kind of snout or proboscis nearly half the length of the animal's body. The mandibles, instead of being jaw-like, and working upon one another like the blades of a pair of scissors, are transformed into two long, slender bristles, exceedingly sharp-pointed and barbed at the tip, like a savage's spear—a pair of most murderous weapons. The maxillæ, too, are bristles, more slender than the mandibles, and equally sharp-pointed; their palpi are easily recognisable as jointed organs visible outside the beak. There is yet a fifth extremely fine hair-like lancet, the representative of an organ which appears in many insects as a prolongation of the central portion of the labium, and is called the *lingua*, or tongue. Labial palpi are absent. All these five lancets lie neatly packed away in the sheath-like labium, and so completely are they concealed that you would never guess that it contained such a collection of instruments of torture. Now for the surgical process by which the little villain obtains its food. We must, however, first acquit half the gnat household of bloodthirsty propensities; the male does not seem to be possessed of these stilettos; he is a mild, inoffensive creature, who generally confines himself to his native swamps, and does not invade the privacy of our apartments; but his spouse is a veritable virago, and boldly intrudes even into our bedchambers, with the view of obtaining an evening repast from the unconscious lord of creation, who lies calmly sleeping within. Gently she alights on some exposed portion of her victim, resting on her four front legs, and daintily elevating the other pair into the air behind her; then she bring her needle-case down on the point chosen for attack, and, forming her needles into a single boring-organ, pushes them through the skin, apparently without much difficulty, till at length she reaches the blood of the sleeper, which is then sucked up the interstices between the bristles till the little phlebotomist is gorged. The irritation caused by these operations is often so great that it has been supposed that poison is injected into the wound; but no poison glands have been detected, and it would seem probable that the incisions themselves are a sufficient cause of the inflammation and consequent irritation.

The *Chironomidæ*, or midges, differ but little from the gnats, save in the mouth apparatus, which is not prolonged into a beak, and is altogether much simpler. They are also unprovided with scales.

(*To be continued.*)

OUR TWO BRAINS.

By Richard A. Proctor.

(*Continued from p. 22.*)

It will be observed that the cases of dual consciousness thus far considered, though alike in some respects, present characteristic divergences. In that of the boy at Norwood, the two characters were very similar, so far as can be judged, and each life was distinct from the other. The next case was only introduced to illustrate the resemblance in certain respects between the phenomena of somnambulism and those of double or rather alternating consciousness. The woman Felida X. changed markedly in character when she passed from one state to the other. Her case was also distinguished from that of the boy by the circumstance that in one state she was conscious of what had passed in the other, but while in this other state was unconscious of what had passed in the former. Lastly in Sergeant F.'s case we have to deal with the effect of an injury to the brain, and find a much greater difference between the two conditions than in the other cases. Not only does the man change in character, but it may justly be said that he is little more than an animal, even if he can be regarded as more than a mere automaton while in the abnormal condition. We find that a similar variety characterises other stories of double consciousness. Not only are no two cases closely alike, but no case has been noted which has not been distinguished by some very marked feature from all others.

Thus, although in certain respects the case we have next to consider resembles very significantly the case of Sergeant F., it also has a special significance of its own, and may help us to interpret the general problem presented to us by the phenomena of dual consciousness. I abridge, and in some respects simplify, the account given by Dr. Carpenter in his interesting treatise on "Mental Physiology." Comments of my own are distinguished from the abridged narrative by being placed within brackets:—

A young woman of robust constitution had narrowly escaped drowning. She was insensible for six hours, and continued unwell after being restored to animation. Ten days later she was seized with a fit of complete stupor, which lasted four hours; when she opened her eyes she seemed to recognise no one, and appeared to be utterly deprived of the senses of hearing, taste, and smell, as well as of the power of speech. Sight and touch remained, but though movements were excited and controlled by these senses, they seemed to arouse no ideas in her mind. In fact, her mental faculties seemed entirely suspended. Her vision at short distances was quick, and the least touch startled her; but unless she was touched or an object were placed where she could not help seeing it, she took no notice of what was passing around her. [It does not appear to me certain that at this stage of her illness she *saw* in the ordinary sense of the word; the sense of touch may alone have been affected, as it certainly is affected to some degree by any object so placed that *it could not but be seen by a short-sighted person.* But it is clear that later the sense of sight was restored, supposing, which is not perhaps probable, that it was ever lost in the early stage.] She did not even know her own mother, who attended constantly upon her.

Wherever she was placed she remained. Her appetite was good, but [like F.] she ate indifferently whatever she was fed with, and took nauseous medicines as readily as agreeable food. Her movements were solely of the automatic kind. Thus, she swallowed food put into her mouth, but made no effort to feed herself. Yet when her mother had conveyed the spoon [in the patient's hand] a few times to her mouth, the patient continued the operation. It was necessary, however, to repeat this lesson every time she was fed, showing the complete absence of memory. "The very limited nature of her faculties, and the automatic life she was leading, appear further evident from the following particulars. One of her first acts on recovering from the fit had been to busy herself in picking the bedclothes; and as soon as she was able to sit up and be dressed, she continued the habit by incessantly picking some portion of her dress. She seemed to want an occupation for her fingers, and accordingly part of an old straw bonnet was given to her, which she pulled into pieces with great minuteness; she was afterwards bountifully supplied with roses: she picked off the leaves, and then tore them up into the smallest particles imaginable. A few days subsequently, she began forming upon the table, out of those minute particles, rude figures of roses, and other common garden flowers; she had never received any instructions in drawing. Roses not being so plentiful in London, waste paper and a pair of scissors were put into her hand, and for some days she found an occupation in cutting the paper into shreds; after a time these cuttings assumed rude shapes and figures, and more particularly the shapes used in patchwork. At length she was supplied with proper materials for patchwork, and after some initiatory instruction, she took to her needle and to this employment in good earnest. She now laboured incessantly at patchwork from morning till night, and on Sundays and week-days, for she knew no difference of days; nor could she be made to comprehend the difference. She had no remembrance from day to day of what she had been doing on the previous day, and so every morning commenced *de novo*. Whatever she began, that she continued to work at while daylight lasted; manifesting no uneasiness for anything to eat or drink, taking not the slightest heed of anything which was going on around her, but intent only on her patchwork." From this time she began to improve, learning like a child to register ideas. She presently learned worsted-work, and showed delight in the harmony of colours and considerable taste in selecting between good and bad patterns. After a while she began to devise patterns of her own. But she still had no memory from day to day of what she had done, and unless the unfinished work of one day was set before her on the next, she would begin something new.

And now, for the first time, ideas derived from her life before her illness seemed to be awakened within her. When pictures of flowers, trees, and animals were shown her, she was pleased; but when she was shown a landscape in which there was a river or a troubled sea, she became violently agitated, and a fit of spasmodic rigidity and insensibility immediately followed. The mere sight of water in motion made her shudder. Again, from an early stage of her illness she had derived pleasure from the proximity of a young man to whom she had been attached. At a time when she did not remember from one hour to another what she was doing, she would anxiously await his evening visit, and be fretful if he failed to pay it. When, during her removal to the country, she lost sight of him, she became unhappy and suffered from frequent fits; on the other hand, when he remained constantly near her, she improved in health, and early associations were gradually awakened.

At length a day came when she uttered her first words in this her second life. She had learned to take heed of objects and persons around her; and on one occasion, seeing her mother excessively agitated, she became excited herself, and suddenly, yet hesitatingly, exclaimed, "What's the matter?" After this she began to articulate a few words. For a time she called every object and person "this," then gave their right names to wild flowers (of which she had been passionately fond when a child), and this "at a time when she exhibited not the least recollection of the 'old familiar friends and places' of her childhood." The gradual expansion of her intellect was manifested chiefly at this time in signs of emotional excitement, frequently followed by attacks of spasmodic rigidity and insensibility.

It was through the emotions that the patient was restored to the consciousness of her former self. She became aware that her lover was paying attention to another woman, and the emotion of jealousy was so strongly excited that she had a fit of insensibility which resembled her first attack in duration and severity. But it restored her to herself. "When the insensibility passed off, she was no longer spell-bound. The veil of oblivion was withdrawn; and, as if awakening from a sleep of twelve months' duration, she found herself surrounded by her grandfather, grandmother, and their familiar friends and acquaintances. She awoke in the possession of her natural faculties and former knowledge; but without the slightest remembrance of anything which had taken place in the year's interval, from the invasion of the first fit to the [then] present time. She spoke, but she heard not; she was still deaf, but being able to read and write as formerly, she was no longer cut off from communication with others. From this time she rapidly improved, but for some time continued deaf. She soon perfectly understood by the motion of her lips what her mother said; they conversed with facility and quickness together, but she did not understand the language of the lips of a stranger. She was completely unaware of the change in her lover's affections which had taken place in her state of second consciousness; and a painful explanation was necessary. This, however, she bore very well, and she has since recovered her previous bodily and mental health.

(*To be continued.*)

THE YOUNG ELECTRICIAN.

By W. SLINGO.

(*Continued from p.* 32.)

A FEW other forms of insulators will probably be found useful, but further reference to them may be deferred until we require them.

A few conducting materials should be kept at hand, for they are as necessary as insulators.

Ex. V.—Half a pound of tinfoil should therefore be added to our stock. It will be found that this highly ductile and easily workable metal will answer more purposes than one would imagine. Tinfoil is procurable almost anywhere at the rate of 2s. 6d. a pound.

Ex. VI.—A sheet or two of tinned iron, which may be obtained for a few pence, may also be procured.

Ex. VII.—For rigid conductors the cheapest material would be iron wire or rod, but brass is preferable because it is softer, easier to work, more ductile, and has a much better appearance. Brass wire about an eighth of an inch in diameter should therefore be laid in stock.

Ex. VIII.—Sometimes a conductor will be required

which must be capable of accommodating itself to the form or shape of any vessel or object in or upon which it may be placed. For this purpose a chain of brass is specially made. The links are, of course, very weak, but more than strong enough to support any length of chain that is likely to be required. It may be obtained at any ordinary electrical instrument maker's for sixpence, or thereabouts, per yard.

To work the articles above mentioned, and for a number of other purposes, afterwards to become apparent, a few appliances are necessary, the first being a source of heat.

Ex. IX.—If gas is available, a Bunsen burner should be obtained. This is simply a burner in which air is mixed with the gas prior to its being ignited. The result is a more perfect combustion, and the production of greater heat, but less luminosity, than with an ordinary gas flame. An iron rose should be procured with the burner. If the flame is luminous or smoky, the burner is not acting properly; air is not being properly mixed with the gas, and the flame should therefore be extinguished and re-ignited. Flexible tubing, sufficiently long to reach from the gas-bracket—or wherever the supply is to be drawn from—to the work-table, will be required. A simple Bunsen burner may be made from a piece of metal tubing three-quarters of an inch in diameter and four or five inches long. Near one end file a few notches with a half-round file, and slip the tube over an ordinary burner. The requisite air will find its way in through the notches.

Ex. X.—In the absence of gas, a spirit-lamp will, in nearly every case, give sufficient heat. A lamp of half-pint capacity will prove a handy size.

Ex. XI. In the hands of one who is able to use it, a soldering-iron is extremely useful; and, even where the young worker has never used the tool before, he will find it advantageous to get one and practise with it. He will soon feel sufficiently familiar with it to employ it satisfactorily. To use it, first heat the iron, and with it run a little resin over the parts to be soldered together. Then "tin" the iron by covering the point of it with solder, when it will take up a quantity of solder, enough for the majority of the purposes for which we shall require it. When insufficient, keep the solder ("strip" solder should be used) against the iron as it is run along the joint, and the metal will run freely so long as the iron retains sufficient heat. It must be borne in mind, that wherever the resin runs the solder will follow, so that to make a neat, and at the same time efficient, joint, the expenditure of a considerable amount of care and trouble will be necessary. Frequently "spirit of salts" (zinc dissolved in hydrochloric acid until the acid is "killed," that is, until it will dissolve no more metal) is used in the place of resin. It is a trifle easier than resin; but in electrical work, when continuity of electrical conductivity is requisite, resin should be employed, as the "spirits" tend to cause a metallic disconnection. This, of course, is not often of much importance when dealing with "static" electricity; but with "current" electricity the case is very different, and resin should then be used *invariably*. The soldering-iron should be heated in a clear fire, but should never be made red-hot. Before tinning, it should be carefully filed, to remove the superficial impurities; and, after once tinning, should be kept always tinned, in which case it will not be necessary to again file the metal, but simply wiping it with a piece of rag will suffice. When spirit of salts is used, the joint should be well washed with water. Let the student experiment in this direction, and he will soon find the advantage of being able to use the soldering-iron.

FIRST STAR LESSONS.

By Richard A. Proctor.

The constellations included in the set of maps are numbered throughout as follows:—

1. *Ursa Minor*, the *Little Bear* (*α*, the *Pole Star*).
2. *Draco*, the *Dragon* (*α*, *Thuban*)
3. *Cepheus*, *King Cepheus*.
4. *Cassiopeia*, the *Lady in the Chair*.
5. *Perseus*, the *Champion* (*β*, *Algol*, famous variable).
6. *Auriga*, the *Charioteer* (*α*, *Capella*)
7. *Ursa Major*, the *Greater Bear* (*α*, *β*, the *Pointers*).
8. *Canes Venatici*, the *Hunting Dogs* (*α*, *Cor Caroli*).
9. *Coma Berenices*, *Queen Berenice's Hair*.
10. *Boötes*, the *Herdsman* (*α*, *Arcturus*).
11. *Corona Borealis*, the *Northern Crown*.
12. *Serpens*, the *Serpent*.
13. *Hercules*, the *Kneeler*.
14. *Lyra*, the *Lyre* (*α*, *Vega*).
15. *Cygnus*, the *Swan* (*α*, *Arided*; *β*, *Albires*).
16. *Pegasus*, the *Winged Horse*.
17. *Andromeda*, the *Chained Lady*.
18. *Triangula*, the *Triangles*.
19. *Aries*, the *Ram*.
20. *Taurus*, the *Bull* (*α*, *Aldeburan*; *η*, *Alcyone*, chief *Pleiad*).
21. *Gemini*, the *Twins* (*α*, *Castor*; *β*, *Pollux*).
22. *Cancer*, the *Crab* (the cluster is the *Beehive*).
23. *Leo*, the *Lion* (*α*, *Regulus*).
24. *Virgo*, the *Virgin* (*α*, *Spica*)
25. *Libra*, the *Scales*.
26. *Ophiuchus*, the *Serpent Holder*.
27. *Aquila*, the *Eagle* (*α*, *Altair*).
28. *Delphinus*, the *Dolphin*.
29. *Aquarius*, the *Water Carrier*.
30. *Pisces*, the *Fishes*.
31. *Cetus*, the *Sea Monster* (*o*, *Mira*, remarkable variable).
32. *Eridanus*, the *River*.
33. *Orion*, the *Giant Hunter* (*α*, *Betelgeux*; *β*, *Rigel*).
34. *Canis Minor*, the *Lesser Dog* (*α*, *Procyon*).
35. *Hydra*, the *Sea Serpent* (*α*, *Alphard*).
36. *Crater*, the *Cup* (*α*, *Alkes*).
37. *Corvus*, the *Crow*.
38. *Scorpio*, the *Scorpion* (*α*, *Antares*).
39. *Sagittarius*, the *Archer*.
40. *Capricornus*, the *Sea Goat*.
41. *Piscis Australis*, the *Southern Fish* (*α*, *Fomalhaut*).
42. *Lepus*, the *Hare*.
43. *Columba*, the *Dove*.
44. *Canis Major*, the *Greater Dog* (*α*, *Sirius*).
45. *Argo*, the *Ship*.

THOUGHT AND LANGUAGE.

By Ada S. Ballin.

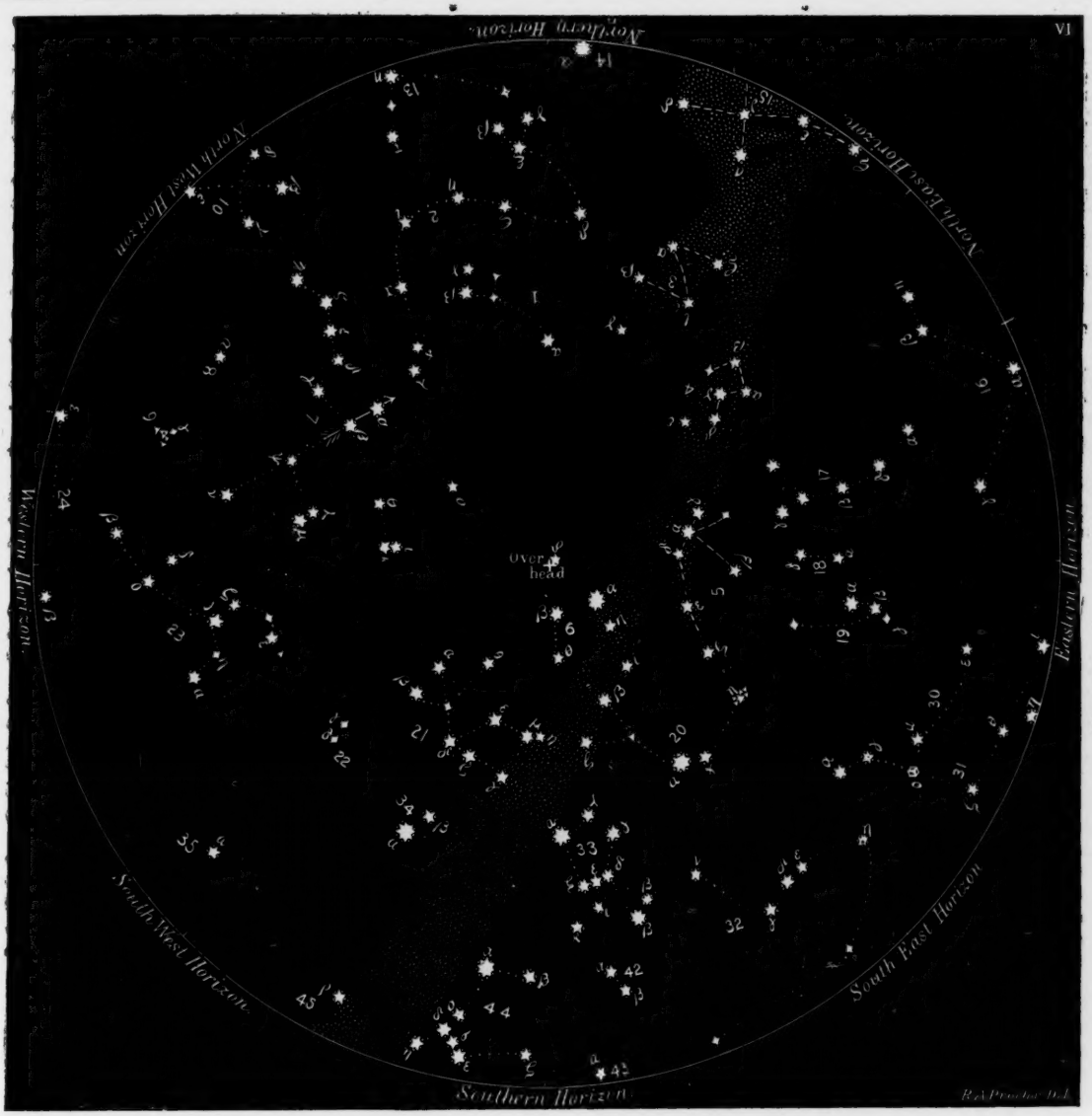
II.

THE problem of the origin of language is one which has occupied the minds of thinkers in all historic times. It is one of those problems inherently impossible of solution, since no data are given with which to work, the birth of language being hidden in the mist of a remote past far anterior to history, and of which there are no records.

Yet in spite of, or perhaps owing to, the very impossibility of proving any theory whatever with regard to it, the number of hypotheses which have been started, purporting to solve the mystery, is exceedingly great; and wise men in all generations, having arrived at their own conclusions on the subject, have been ready to defend them against the world.

One of the most ancient theories was that of the Assyrians, dating from about 2,000 B.C.—it asserted that language was a divine gift, and was given as a whole to all men, and it accounted for the variety of languages then current by the story of the Tower of Babel, in which men were punished, for their attempt to besiege Heaven, by a confusion of tongues. This theory was afterwards adopted by the Semites; we find it stated fully in the Book of Genesis, chap. xi., and later on, the Koran II., 29, expressed the same idea in the statement that Allah "taught Adam the names of all things."

Language has in all ages been regarded by the majority as a complete whole created as such, and perfect in itself



NIGHT SKY FOR JANUARY (SECOND MAP OF PAIR),

Showing the heavens as they appear at the following hours:—

January 22 at 10 o'clock.	February 2 at 9¼ o'clock.	February 14 at 8½ o'clock.
January 25 at 9¾ o'clock.	February 6 at 9 o'clock.	February 17 at 8¼ o'clock.
January 29 at 9½ o'clock.	February 10 at 8¾ o'clock.	February 21 at 8 o'clock.

from the very first. But this is not a view which the theory of evolution could lead us to accept; it can only be adopted by those who, ignoring all the facts of evolution, delight to believe in the theory of special creation. As a typical exposition of this theory, I venture to literally translate the following passages by M. Renan: "Language at all times seems to us to be parallel to the human mind. Now, from the very first moment of its constitution, the human mind was complete; . . . Has man acquired his different faculties successively? Who can even dare to think it? We can establish a rigorous analogy between the facts relating to the development of mind and the facts relating to the development of language. It is, therefore, impossible to imagine language painfully completing its different parts, because it is impossible to imagine the human mind seeking its faculties one after the other."* In another place he says: "It is, therefore, a dream to imagine a primitive state in which man did not speak, followed by another stage in which he had acquired the use of language. Man speaks naturally as he thinks naturally, and it is as bad philosophically to assign a voluntary beginning to language as to thought;" † and he continues, "Hence the different systems of language were not formed by successive juxtapositions,

* "Histoire les Langues Sémitiques," Livre V., chap. II., p. 471.
† "De l'Origine du Langage," p. 91.

but like the living creatures of nature, language from its first appearance was endowed with all its essential parts." * Now the whole theory of evolution is in direct contradiction to that of M. Renan, and the class he represents, for it teaches that the mind of man was gradually developed through successive stages, from such a state, for instance, as we find in a sponge at the present day; the mind developing in proportion as the nervous system becomes more complex. Other animals, inferior in development, have, as I pointed out in my former article, a definite language of sounds and signs, but as Darwin says,† "Man not only uses inarticulate cries, gestures, and expressions, but has invented articulate language; if, indeed, the word *invented* can be applied to a process completed by innumerable steps, half consciously made."

In one respect only does Darwin agree with Renan; they both allow that language did not have its origin in the will of man, though, indeed, long before these two representative thinkers, Turgot had said: "Languages are not the work of conscious reason."‡

In point of fact, there can be very little doubt that language was evolved, like everything else, from small beginnings. Some primitive being, while directing the attention of one of his kind to a certain object, uttered some sound, which, being afterwards repeated in the same connection, came to be appropriated to that object, and it was found that the object might, although absent, be indicated by the use of that sound. This was a step in the right direction. It was manifestly desirable that attention should be drawn to the approach of an enemy while that enemy was still at a distance, or that the whereabouts of prey should be indicated while the prey was not within ken.

Random action becomes voluntary action, if it is found to give or continue pleasure, or to avert or lessen pain. Hence the sound uttered at random, but found to be useful in communicating a thought, is perpetuated as what we should now call a word, and a multitude of such makes up a primitive language.

In another work Darwin says:—"From the fundamental differences between certain languages, philologists have inferred that when man first became widely diffused he was not a speaking animal; but it may be suspected that languages far less perfect than any now spoken might have been used, and yet left no traces on subsequent and more highly-developed tongues. Without the use of some language, however imperfect, it appears doubtful whether man's intellect could have risen to the standard implied by his dominant position at an early period."§

With his wonderful insight into the ways of nature, Darwin has in the suggestions of the above passage, probably happened upon the true state of the case, and doubtless at first all communication was as among other gregarious animals, by gestures and cries warning of danger, or to gather together for attack.

Weak animals find strength in numbers, and become gregarious on a sort of extension of the principle that "two heads are better than one." Thus, herds of different creatures will, as it were, post sentinels so that the body of the herd may feed in safety, confident that a timely alarm will be given in case of the approach of an enemy.

In the same way we find that defenceless animals are proportionately cunning, the instinct of self-preservation sharpening their mental powers. Travellers in countries where before their time man was unknown, have found the small game and birds so tame that they could almost catch them in their hands, but after a few years', or even months' experience of perfidious man and his shot-gun, they become as shy as the ordinary sportsman generally finds his prey, that is to say, they have learnt where the danger lies and devised means for avoiding it.

Now, when in the course of evolution a being was developed bearing the physical attributes of man, he must have been indeed a weak and defenceless creature compared with those animals by which he was surrounded, and who hungered for his blood. There is some reason to believe that primitive man was not nearly so large or powerful as the ordinary savage of the present day, who, even with his superior advantages, would, without cunning, stand but a poor chance in the struggle for existence.

The primitive man must have been beset on all sides by dangers and difficulties. He had neither the powers offensive nor defensive possessed by his neighbours. He had neither the swiftness of the weaker kinds to escape, nor of the stronger to pursue; and he was without the natural weapons with which other animals were provided. His only chance lay in the development of his mental faculties; without cunning he must certainly have perished, as hundreds of other weak species have probably done, and left "not a wrack behind."

This being so, his mental powers were stimulated by the instinct of self-preservation common to all creatures, and like other weak animals he formed an offensive and defensive alliance with others of his kind.

Such an alliance rendered necessary some means of communication between the allies, and there is every reason to believe that this necessity, if not the mother, was at any rate the ancestress, of articulate speech, which was thus only one of those phenomena of mental evolution that have placed him in the dominant position which he now occupies with regard to other creatures.

Man's mind was developed by the struggle for existence, in which it had to contend against two great difficulties, that of getting food for the man, and of saving him from becoming the food of other animals; without this development man would have disappeared in the course of digestion.

* "De l'Origine du Langage," p. 99.

† "Expression of the Emotions," p. 60.

‡ "Les Langages ne sont point l'œuvre d'une raison présente à elle-même."

§ "Descent of Man," Vol. II. pp. 234-5. Ed. 1872.

MANNERS AND CUSTOMS IN AMERICA.

By Richard A. Proctor.

ENGLISHMEN are apt to make the same sort of mistake about American manners and customs as I have already suggested* that we are apt to fall into in regard to the gambling spirit there. Just as poker-players are more conspicuous features in America than the corresponding classes of gambling folk in England, so the classes among whom solecisms in manner may be expected come much more under our notice in America than in our own country. It by no means follows they are more numerous. On the contrary, there is every reason to think that they are much less numerous there than here. At a railway dining-room on the long American lines, and at the table of the solitary hotel in some small Western town, all classes meet at meals: can it be wondered at if peculiarities of manner, such as are never seen in English "first-class refreshment-rooms," should at times be noticed? If an Englishman really limited his attention to what is general as well as novel to him, he would be chiefly

* See Knowledge, No. 165.

struck, I think, by the politeness with which nearly all men in America, even of the humbler orders, treat women. Defects of breeding may be noticed, of course, and some of them are tolerably general in the Western States, but they mostly affect mere externals, not the real amenities of life. Albeit one could wish that, instead of the better bred falling into the ways of those less fortunate in regard to breeding, they should set steadily a good example even in externals. It may be a matter of no moment, for instance, that here or there a working man or woman should put his food into his mouth with his knife. But for those who have pleasanter ways of eating to fall into the same ugly habit because they are surrounded by folk who know no better, is surely a mistake. I have repeatedly seen people of good social standing do such things in the far Western States, though they must know perfectly well the more seemly habits which good breeding enjoins. I feel somewhat ashamed of myself if my gorge rises when a labourer puts food into his mouth with a knife, and a semi-scientific question arises in my mind as to the origin of a feeling so fanciful and artificial. But when persons who have had better opportunities indulge in the same habit, the case is different: I no longer wonder or feel ashamed at the sense of disgust which comes over me when I see the knife (to consider this particular solecism for the moment) put to this improper use. And I notice another singular circumstance. To see a knife, held in the ordinary way, go into the mouth loaded with what does not belong to it, is unpleasant enough; but the feeling of disgust is curiously intensified when the knife is held in that way which the labouring classes have quite ingeniously invented to make the knife more serviceable. Perhaps if two-pronged forks were still in use, and spoons had not been invented, we might be driven to the use of the knife as a sort of spoon. Then we should do as the labouring folk do; when we wanted to use a knife as a spoon, we should turn the knife's edge *from* the mouth (setting the thumb against the back of the knife), and so bring the back instead of the edge into the mouth. When I see a working man or woman do this, I am rather pleased with the ingenuity of the method, than disgusted at the wrong use of the knife. But to see a person in good social position adopt this workmanlike way of using the knife, produces a different effect. Beau Nash used to express much stronger objection to a darn than to a hole in the silk stockings of his day, for, said he with foolish wit, "a hole may be the accident of a day, but a darn is deliberate poverty." In like manner, but with better reason, one may pass over the carelessness which has led some once well-bred persons in America to fall into the habits of less fortunate folk around them, to speak ungrammatically, mispronounce words, and so forth; probably the most of us would do the same after passing many years among the rougher sort of people; but to see a lady or gentleman set the thumb on the back of the knife and use the blade in the workmanlike fashion I have described (showing they have not merely fallen into a bad habit, but have deliberately learned how best to follow it), this is truly distressing. I have not only seen this, but I have seen persons of good social standing calmly feed an infant with the knife point! Yet, oddly enough, one may often notice that while the seniors in a family have adopted these hateful ways, and the infants are made familiar with knife-blades from babyhood, the grown boys and girls in the same family would as soon think of putting a knife into the mouth as of putting their fingers into a dish. The criticisms of writers like Dickens, Mrs. Trollope, and so forth, however harsh and even rude they may have been, have had this good effect at least: the young people who have read, marked, and inwardly digested such notes about manners and customs have corrected many ugly ways which otherwise they might have adopted or retained.

One could wish the good effect had extended to language; but though the young people, especially the ladies, speak much more correctly than their elders, and sometimes with perfect accuracy, it must be admitted that in some of the Western States of America the English language has degenerated terribly.—*Newcastle Weekly Chronicle.*

DINOSAURS.

(*Continued from p.* 27.)

AMONG the animals found in the Rocky Mountains, the strangest beast is doubtless the brontosaurus, of whose skeleton we give a restoration according to Professor Marsh (Fig. 4). This animal reached a gigantic size; living, it

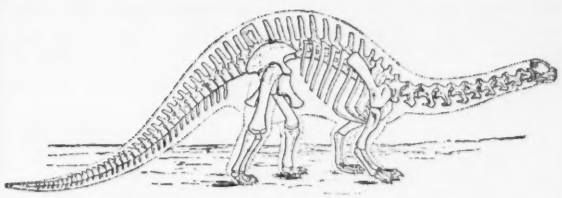


Fig. 4.—Skeleton of Brontosaurus (×1-125).

mus have weighed at least thirty tons! The head is remarkably small for an animal of such a size. The brain, which is extremely small, indicates a slow and stupid beast. The neck is long, flexible, strong, and very mobile, the legs are massive, and the bones solid. The animal walked after the manner of our present bears, its body was entirely naked, its habits more or less aquatic, and it must have frequented muddy swamps pretty much as the hippopotamus does. Its food consisted of plants that grew in the water or near the banks.

Not far from the French frontier, between Mons and Tournay, in Belgium, is located the Bernissart coal-mine. In order to reach the bed of coal it is necessary in that country to excavate the earth to a certain depth, and traverse strata which were deposited subsequent to the formation of the valuable combustible. In making researches at Bernissart for extracting coal, some wealden strata were encountered in a valley that dated from the beginning of the Cretaceous epoch, and that was afterward filled through the movements of the earth. Fishes by hundreds, crocodiles of unknown types, and gigantic reptiles here lay buried at a depth of almost 1,150 feet, nearly in the spot where they formerly lived. They were buried in mud, and lay pellmell along with the plants that grew upon the ground that they had trod at an epoch so remote as to exceed all imagination. These gigantic animals thus brought to light, thanks to the persevering researches of De Paux and Sohier, were dinosaurs belonging to the genus iguanodon, the first remains of which were found by Mantell in 1822.

It is to the labours of Boulenger and Van Beneden, and especially to those of Dollo, that we owe our knowledge of one of the strangest beings that ever existed in olden times. The discovery of the Bernissart iguanodon—an animal whose entire skeleton is now known—has thrown an absolutely new light upon the structure of a whole group of herbivorous dinosaurs.

Everything, in fact, is strange in the iguanodon (Fig. 5). Its stature, as well as its gait, is well calculated to astonish the naturalist who is acquainted with existing reptiles only—beings which are very puny as compared with animals that lived in former times.

The Bernissart iguanodon measures nearly thirty-three feet from the end of the nose to the tip of the tail, and, when standing upright upon its hind legs (the attitude that it assumed in walking), it rose to more than thirteen feet above the level of the ground. The head is relatively small and much compressed, and the nostrils are spacious and as if partitioned. The temporal fossa is limited by a bony arch, above as well as below—a character entirely exceptional in existing reptiles. The extremity of the jaws were apparently provided with a beak designed for cutting the large ferns and the cycadaceæ that grew upon the margins of the lagoons and marshes into which the earth was cut up. The teeth, which are crenulate at the edges, indicate an essentially herbivorous diet, and they were replaced as soon as worn out. The neck must have been very mobile. The ribs, which are strong, indicate vast lungs. The fore limbs, shorter than the hind ones, terminate in a five fingered hand. The thumb is provided with a large spur, which must have been a formidable weapon. The hind limb, which is digitigrade,

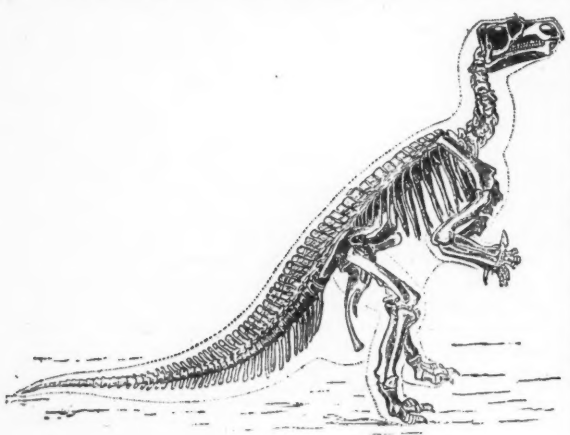


Fig. 5.—Skeleton of Iguanodon.

is provided with but three fingers, which were probably connected by a web. The pelvis more closely resembles that of birds than that of existing reptiles. The tail, a little longer than the rest of the body, is about sixteen feet in length, and consists of nearly fifty vertebræ. It is much compressed laterally, like that of the crocodiles, and must have served as a rapid and powerful means of propulsion.

"The circumstances under which the Bernissart iguanodons were found show, as Mr. Dupont has pointed out, that these animals must have lived in the midst of marshes and upon the banks of a river. It is consequently not surprising that they had aquatic habits.

"Granting that the iguanodons passed a portion of their existence in water, we can imagine, by the aid of observations made upon the crocodile and *amblyrrhynchus* (a large marine lizard of the Galapagos Islands), two very different modes of progression of our dinosaur in the liquid element.

"When it was swimming slowly, it made use of its four limbs and its tail. If, on the contrary, it wished to move forward rapidly in order to escape its enemies, it placed its fore limbs against its body, and made exclusive use of its hind ones and of its caudal appendage. In this mode of progression, it is clear that the smaller the fore paws are the more they are hidden, and consequently the less resistance they offer to the movement of the animal in the water. In confirmation of this, we observe that, among the forms that swim in the manner just stated, the fore limbs are so much the smaller in proportion as the beast is the more aquatic.

"The iguanodons walked on the ground by the aid of their hind legs only; in other words, they were bipeds after the manner of man and of a large number of birds, and were not jumpers like the kangaroo; moreover, they did not rest upon the tail, but allowed it simply to drag.

"But, it will be said, just now in speaking of aquatic life, you compared the iguanodon with the crocodiles; yet the latter are not adapted for an erect attitude. What need, then, had the iguanodons of a bipedal walk if they had analogous habits? It appears to us, on the contrary, that standing upright must have been a great progress, and for the following reason:

"These animals, being herbivorous, had to serve as prey to the carnivora of their epoch; and, on another hand, they remained in the midst of marshes. Among the ferns by which they were surrounded they would have observed the approach of their enemies with difficulty, or not at all; but, standing upright, they were enabled to look about them to a considerable distance. Upright, too, it was in their power to seize their aggressor between their short, but powerful arms, and to bury their two enormous spurs into its body. These spurs, it is probable, were provided with a cutting edge.

"The difficult progression of the crocodile upon the ground has been described by all travellers, and there can be no doubt that the long tail of this animal contributes not a little to its awkward gait. The transformation of this cumbersome organ out of water into a balance was, it seems to us, a happy modification.

"Finally, the bipedal walk must certainly have allowed the iguanodon to more quickly regain the river or lake in which it disported than would a quadrupedal walk that was continually interfered with by numerous aquatic plants that played, after a manner, the rôle of brushwood.*—*Science et Nature.*

THE REFORMATION IN TIME-KEEPING.†

By W. F. Allen.

On Nov. 19, 1883, the daily papers of the United States and Canada, from the Atlantic Ocean to the Rocky Mountains, contained more or less elaborate accounts of the change from local to "standard time" which had been made on the previous day. Comparatively few among the millions of people who read these accounts took the trouble to investigate the actual meaning of the change or the arguments in its favour. It appeared to be the work of practical railway managers, and to be favoured by leading scientists. Watchmakers agreed to and aided the change, and few other persons were apparently interested. So the people quietly acquiesced, reset their watches a few minutes faster or slower, and for the most part soon forgot that any but "standard time" had ever been in use.

In the present generation we have become so accustomed to the use of accurate time and the ready means of obtaining it, that we hardly realise how dependent we are upon it.

* L. Dollo, Les Iguanodons de Bernissart.

† From the *Popular Science Monthly.*

Were it possible to suddenly destroy all clocks and watches in any given centre of population among civilised nations, while all other surroundings of modern development remained as before, we can scarcely conceive of the endless confusion that would arise. Only by contemplating the results of such a catastrophe can we fully understand what an important part the knowledge of accurate time plays in our every-day affairs.

Man shares with the inferior animals the knowledge and the use of the simplest and earliest division of time into day and night, and in a more restricted sense into seasons. The division of the day into minor parts has been developed by man as necessity or convenience required. It has not been many years since watches were made with hour-hands only, and the general use of the finer divisions into minutes and seconds is almost entirely the outgrowth of the requirements of modern civilisation. Astronomical time-keeping is not here considered. By the Babylonian system of dividing the day, which was used by the Jews and other Oriental nations, the time between sunrise and sunset was portioned into twelve equal parts at all seasons of the year, the hour varying in length with the season. If this method of division still prevailed, the hours in New York city would vary in length from about forty-six to about seventy-five of our present minutes. In the Arctic regions the inapplicability of this system to general use would reach its climax of absurdity.

The general facts upon which all systems of time-keeping are based are commonly understood, but the details are seldom referred to.

The most primitive kind of timepiece is a sun-dial. Reduced to its simplest form, a sun-dial consists of a straight pole erected upon a permanently fixed circular plate, the shadow of the pole indicating midday when it coincides with a line drawn due north from the base of the pole, the pole being erected upon a line parallel with the axis of the earth. The other hours of the day are indicated by marks upon the circular plate upon which the shadow of the pole successively falls.

When the sun-dial was invented cannot be stated. It was of very ancient origin, and is mentioned in the thirty-eighth chapter of Isaiah. The clepsydra, or water-clock, and the hour-glass, although very ancient, must from their nature have been invented subsequent to the sun-dial. But sun-dials, of which there are about a dozen different kinds, although common, were never in such general use as clocks are in modern times, and were philosophical rather than popular instruments. The clock was invented about 1379, and the pendulum as a regulating power in 1657.

The rapid development of the science of horology in the present century has been almost coincident with and in no small degree dependent upon the construction and operation of railway and telegraph lines. The needs of these great engines of modern civilisation created a general demand for exactness in time-reckoning which had never existed before. It was required both for the use of their *employés* and for the public which patronised their lines.

A sun-dial being stationary, when properly made and adjusted, exhibited solar time correctly, and a watch regulated from the dial by the equation of time would also be correct for that particular spot, but the moment the owner of the watch began to move east or west, his timepiece no longer registered correct time, and when he travelled with the speed of a railway train the error was rapidly exaggerated.

The necessity for exactness before mentioned, and the impossibility of adhering to local time, early attracted the attention of railway managers, and caused them much perplexity and annoyance. With the rapid construction of railway lines, the commingling of the various local standards soon became decidedly intricate. Travellers were greatly inconvenienced by the lack of knowledge of the standard upon which the time of trains as advertised was based, and to such the situation was full of difficulties. Some of these difficulties were stated in an "open letter" published in "The Century" for September, 1883. The subject in its practical aspect also attracted the attention of scientists and scientific societies. It became a prominent topic of discussion at meetings of the American Metrological Society, the Association for the Advancement of Science, and the Society of Civil Engineers. Although astronomers use sidereal time, based upon the position of the stars, and not of the sun, in common with many other scientists they were generally warmly interested in the subject.

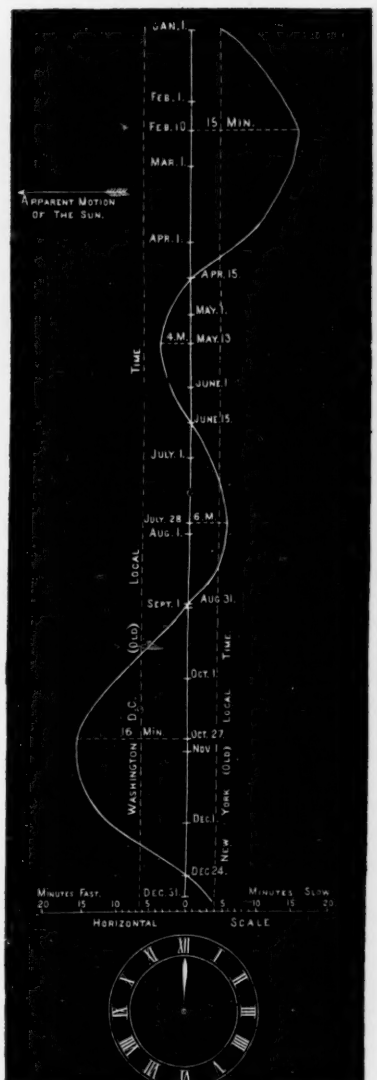


Fig. 1.—Diagram showing comparison of mean (or clock) time with solar (or apparent) time, at the several seasons of the year. The perpendicular central line represents mean time, and the curved line solar time, at mean noon.

The local time kept by clocks is an average of solar time, and is properly designated "mean time," as distinguished from the variable time shown by the sun-dial. No clock or watch can be made to keep the time as shown by the sun-dial, and this new system of time-keeping, therefore, became necessary when clocks and watches were invented. The relation between mean and apparent time, and what is meant by the "equation of time," may be seen at a glance by reference to the accompanying diagram. Mean time being represented by the right line graduated for the several months of the year, the variation of apparent time is shown by the curved line entwined around it. In other

words, a line drawn through the several positions of the sun at mean noon will describe the curves as indicated. For reasons which need not here be stated, the diagram will be found generally correct for one year only out of four; but, upon the scale by which the diagram is drawn, this error is infinitesimal. It is hardly necessary to state that the principal cause of the variation between mean and apparent time is "the obliquity of the ecliptic to the equinoctial."

Apparent time is about fifteen minutes slower than mean time about Feb. 10, and about sixteen minutes faster on Oct. 27. They agree about April 15, June 15, Aug. 31, and Dec. 24. If a well-regulated clock were set by apparent time on Oct. 27, it would be about thirty-one minutes faster than apparent time on the following Feb. 10. It will be seen that, under such circumstances, clock-time would vary as much from true sun-time as any clock set by the present system of standard time varies from mean-time at the most extreme point.

The safe operation of a railway requires that the watches of all its employés upon, or who have occasion to refer to, the same trains should always indicate the same moment of time. Railway-time upon lines running east and west can, of course, never coincide with mean local time except at a single point, and the longer the line of the road the greater will be the variation. Before the recent change to standard time there were several cases where the railroad-time in use differed by more than half-an-hour from mean local time at various points. The inhabitants of the surrounding country at such points, having no standard of reference except the railway-clocks, accustomed themselves to and used railway-time without inconvenience, and in a number of instances, where the railway standard was changed from some cause, the people made the same change in their time-pieces. It was important in connection with railway-trains to keep exact time, and for all other purposes any relative time was sufficiently accurate.

In the early part of the year 1883 there were fifty-three standards of time in use on the railroads and by the people of the United States and Canada. These standards governed sections with no definite limits, and upon railroad lines were apparently inextricably mixed and interwoven. The condition of the matter was abnormal in numerous instances, there being no less than three hundred points where railroads, using different standards of time, crossed each other and exchanged traffic. At almost every city of importance several standards were used by the railways, and in some cases the city time differed from any of them. Local jealousies made the chance of effecting reform apparently hopeless. Many who warmly favoured standard time regarded the reform as one unlikely to be soon accomplished.

The solution of the problem necessarily required a close and long-continued study of the peculiarities of the situation. Whatever change was proposed must affect as little as possible the relations which previously existed between railway lines and business communities.

(To be continued.)

We have received from Messrs. W. & R. Cheshire an engraving executed by them from a drawing by Mr. Allan Barraud, which as an example of wood-cutting is as delicate and beautiful as anything that we have seen.

Economical Steam Tramway.—The Dewsbury, Batley, and Birstal Steam Tramways—the first ever constructed in England—worked by Merryweather 7-in. engines, show in the half-year's working accounts that the total cost of the running of the engines is 2·57 pence per mile, and the total expenses of the whole establishment, including locomotive charges, 5·16 pence per mile. This is one of the most economically-worked lines in the country.

CHAPTERS ON MODERN DOMESTIC ECONOMY.

XII.—THE FRAMEWORK OF THE DWELLING-HOUSE.

GENERAL PRINCIPLES OF CONSTRUCTION—(*continued*).

In continuation of our observations upon the practical details of the hydraulic system for the removal of excrementitious waste, we may note:—

(ii.) That the soil-pipe ought to be well ventilated. The ventilating-pipe should be an upward prolongation of the effluent soil-pipe which leads to the house-drain, and should be carried up above the roof of the house; preferably over the chimney-stack, where it ought to terminate in a suitable ventilating head. The kind of ventilator known as an "exhaust" or an "induced current," ought to be employed. The extraction of foul air from the pipe should be effected by passive means; that is to say, the external currents of air, however they may come into contact with the apparatus, should not only be prevented from causing a downward draft, but, on the contrary, ought to produce an upward current, and that without any revolution or other noisy movement of the appliance. This exhaustion of the gaseous contents of pipes is of as great importance to the drainage system as to the thorough ventilation of the general apartments and passages of the house, including its chimneys.

The ventilator should provide: (*a*), that at what ever angle the wind strikes its head, such action shall produce a partial vacuum therein, and thus secure a powerful upward current and no down-blow; (*b*), that a very slight breeze shall be sufficient to induce the vacuum, thereby securing an approximately continuous upward current; (*c*), that the apparatus shall be inexpensive, durable, and ornamental; (*d*), a negative quality is, that it shall not be subject to any movement—the revolving ventilator is not only a noise-producing invention, but, in consequence of its motion, soon wears away; it moreover requires a "pretty stiff wind" to set it in action, and during quiescence of the aërial currents, a slight breeze, in striking against its blades, is only sufficient to pass between them and produce a down-blow.

It is a very common error, amongst even modern builders, to decrease the diameter of the ventilating portion of the soil-pipe; such, however, is not in consonance with the laws of sanitary physics, and ought not to be permitted; the escape of sewer-gas is retarded by the smaller bore of the ascending tube, and is apt to give trouble lower down at the closets and house-sewer traps; the foul air may even eat holes into the metal pipes, and thus escape at undesirable places. There should always be an inlet for fresh air at the base of the soil-pipe, on the house side of the dip-trap, between the house and the sewer. We shall give examples of some of the practical arrangements which have been devised to meet these requirements in a future communication.

(iii.) The angle of junction of the soil-pipe with the house-drain ought to be such as to afford a ready passage of the contents of the one into the other, or, better still, angles should be altogether avoided, and curved junctions substituted for them. This may seem to be self-evident to most persons, but it is, in fact, a most serious and prevalent cause of obstruction in the sub-household sewerage arrangements of very many tenements. In some cases the angular junction is almost, if not quite, rectangular, and thus affords facility for the accumulation of solid particles, and finally for the occlusion of the drain itself.

The drain itself ought to have a fall of about one foot

in every 50 feet; or, in default of that, should be provided with a special and effective flushing apparatus. An insufficient fall is conducive to the collection of filth, as the sewage cannot pass away into the main drains as quickly as it ought to. The pipe may be constructed out of non-corrodible metal, such as "Barffed," or glazed iron-ware. Barffed iron consists of iron coated with a layer of the magnetic oxide of iron; it is induced through the agency of superheated steam, and is so called after its inventor, Professor Barff. The layer of magnetite is dull dead-black in colour, and we cannot imagine why it has not been more extensively employed since its introduction into this country some few years ago. There cannot be anything more suitable for the preservation of out-door iron-work, domestic utensils, &c. We shall have occasion to review Professor Barff's system in greater detail when we come to treat of household furniture. But to return to our subject. The drain-pipes may be made of stoneware, and in this case its joints ought to be made gas-tight, and encased in a bedding of concrete. A caution is here necessary, on account of "scamped work"; the house-drain is, of course, entirely out of sight, and advantage is taken of that circumstance by both workmen and builders. Faulty workmanship here is of two principal varieties, viz.:—(1.) Builders who are not well acquainted with the subject of drain construction, and there are many such, may make use of unsuitable materials wherewith to joint the stoneware-pipes, *e.g.*, clay. Now, clay is not permanently waterproof, because it is liable to suffer from thermal changes to such an extent, that in time it becomes cracked and decrepitates; its compressibility, too, when freshly applied, is such that the weight of the overlying earth very often suffices to squeeze it out of the joints of the pipe, with the result of a dangerous leakage; it is, moreover, prone to the incursion of the roots of trees and shrubs in its extra domestic course, which are attracted by the moisture, and may even find their way through the clay-joint into the duct, and eventually block up the drain. (2.) Stone pipes with bad joints are very often used, and the defects are glossed over by incomplete cementing; the joints are carefully sealed at the top, but left almost unattended to underneath. The result of this is that superficial inspection is thwarted until the foul discharge becomes too evident to be mistaken; the ground is impregnated with unwholesome and poisonous matters, and the atmosphere of the house thus open to direct contamination.

(iv.). The house-drain leads into the main general sewer, and it is, therefore, of the first importance that it should be isolated therefrom by a suitably-trapped contrivance. If this principle is not carefully observed in practice, the sewer-gas from the main may enter the domestic drain, and find its way therefrom, through defective arrangements or accidental circumstances, into the house. It is impossible to estimate the harm that is liable to, and very often does, arise from this source; the disease-germs from a far-distant area are readily imported and disseminated in the very midst of an otherwise well-regulated and healthy home; and since it has been demonstrated that the most virulent of maladies are those which arise through ferment-producing germs of infinitesimal size, whose growth and multiplication are specially favoured through the conditions provided by the sewers, it is obvious that too much care cannot be bestowed upon the complete isolation of the household drains from the common district sewers.

In our next communication we shall conclude the subject of house-drainage and its accessories, and pass on to the consideration of the principles of chimney-flue construction and the arrangement of fire-places. It will then be time for us to furnish a serial, illustrated, and technical, description of the numerous valuable examples which have been introduced to meet the requirements of the principles we have already enunciated.

(*To be continued.*)

Editorial Gossip.

I DO not quite understand why the Gold Medal of the Royal Astronomical Society has been awarded to Dr. Huggins this year. His wonderful and imperishable work on the Motions of Stars in the line of sight, and his Spectral Photography of the Stars and Comets, were performed just sufficiently long ago to induce the astronomer who views the question from the outside to inquire why he, who is *facile princeps* among our British spectroscopists, was not thus rewarded before. Having waited so long, he could now have further done so, until some recognition of recent splendid American astronomical work had been made.

LET no country cousin who reads the advertisements of the Crystal Palace imagine that he can obtain the day's amusement which the Company announce for the advertised shilling. I went in there an afternoon or two ago, and remained from 3.20 to 5.30 (or shall I say from 15.20 to 17.30?), only to find that I was rigidly confined to an inspection of a series of Lowther Arcade stalls! A pantomime was, I heard, being performed in the transept, but the whole place was most carefully enclosed in canvas, so that nothing could be seen without the extra payment of 2s. 6d., 1s. 6d., or 1s. Close to the theatre was Dr. Lynn's Thauma, "admission 6d." At the end of the building was the Aquarium, 6d. more, and so on—everything, as I have said, save these Arcadian stalls, being charged extra for. The sculpture and other courts were closed—I fancy for the purpose of varnishing the floors. In short, I felt that I never in my life had wasted a shilling more than I had on that occasion.

ALL who recollect the blatant profession of high educational aims with which the public were originally addressed in connection with the great glass structure at Sydenham will be able to appreciate the miserable policy which dictates this "Bartlemy fair" arrangement. It would be far more honourable on the part of the management to charge half-a-crown at the doors, and admit their visitors for that sum to all their show, than to entrap people into paying to enter a place in which every separate item of amusement is made the subject of a fresh extortion. It is as contemptible as the Directors must, and will, find it to be suicidal, to treat their visitors in such a fashion.

I HAVE from time to time addressed cautions and intimations to correspondents through the legitimate channel (I mean our Correspondents' Column) with, however, seemingly but indifferent success. I will reiterate some of them here, in the hope that they may meet with more attention. First, it is useless for people to write asking Mr. Proctor to lecture: his lectures are definitely at an end. Next, I neither sell nor buy numbers of KNOWLEDGE: booksellers or newsagents will supply single copies, as will Messrs. Wyman, who also receive annual subscriptions. Sellers of back numbers must advertise them. Thirdly, no correspondents whatever are answered by post; all such will find

their communications dealt with in the "Letters Received and Short Answers" column, while their stamped envelopes are simply dropped into the waste-paper basket. Fourthly, I am not a private tutor or "crammer," and cannot undertake to recommend text-books for examinations. Lastly, I will not return any rejected communication unless it be accompanied by an envelope legibly addressed and sufficiently stamped for that purpose. I do hope that would-be contributors will save their time and my temper by attention to these hints.

Reviews.

SOME BOOKS ON OUR TABLE.

The Engineer's, Millwright's, and Machinist's Practical Assistant. By WILLIAM TEMPLETON. (London: Crosby, Lockwood, & Co. 1885).—That Mr. Templeton's capital and most useful collection of tables and formulæ should have run into a seventh edition will surprise no one who has any idea of its multifarious and most diversified contents. It is verily a perfect *vade-mecum* for the mechanic of every kind, be he professional or amateur—as good as it is cheap and portable.

The Reporter's Handbook and Vade-mecum; How to get Speed in Shorthand; The Phonetic Journal (London: F. Pitman).—We class these three works together as showing in their respective fashions the slow and silent spread of the Phonetic system. With reference to the first of them, though, we may add that it is of equal value to everybody whom duty or pleasure may call upon to contribute narrative matter to the press, whether he be a stenographer, or pen his account in the longest of long-hands. Its hints are really valuable to all such.

An Introduction to French Conversation. By ANTOINE CHARLIN (London: Hachette et Cie.).—This very extensive collection of the most heterogeneous idiomatic French phrases appears to be well calculated to help the earnest student to proficiency in talking the language. Grammar, in the ordinary acceptation of the word, is ignored altogether; not one single "rule" appearing between the two covers of the book. The English sentences appear on the left-hand page; their French equivalents on the right-hand one. Any one who will seriously work through M. Charlin's work will have acquired a colloquial knowledge of the French language, hardly to be obtained without very many months of study under the ordinary unscientific method.

The London Science Class Books: Key to Hydrostatics and Pneumatics. By JOHN MURPHY. (London: Longmans, Green, & Co. 1885.)—This little volume contains the working out at length of every example in Magnus's "Hydrostatics and Pneumatics," and will be found alike useful to the teacher and to the self-instructed learner.

Overwork from the Teacher's Point of View. By Mrs. S. BRYANT, D.Sc. (London: F. Hodgson. 1885.)—According to Mrs. Bryant, there is practically no such thing as "overwork" in schools—at all events, in girl's schools. Those who wish to follow the train of reasoning by which she has persuaded herself of this should consult her pamphlet.

A Review of European Society, &c. By J. SKETCHLEY. (London: W. Reeves.)—If any astute Conservative leader wished utterly to disgust every man of the slightest degree of education and culture with the doctrines of Socialism, he could scarcely do so better than by circulating broadcast the *ad captandum* appeal to all that is low and selfish in the lower stratum of society, contained in the work whose title heads this notice. That the existing condition of many of the labouring classes is referable to their own conduct, never seems to have occurred to Mr. Sketchley, whose idea of a perfect State would seem to be one of a condition of things in which every one, clever and stupid, idle and industrious, drunk and sober, should share and share alike under a State despotism as grinding as that of any Eastern monarch; as assuredly it must be whether administered by "the People" or not. No greater fallacy can exist than that hidden under the idea that a Republic is, *ex necessitate*, a *free* form of government. All modern Radical legislation tends in the direction of interference with personal rights.

Spon's Mechanic's Own Book. (London: E. & F. N. Spon, 1885.)—This is, in reality, a compact encyclopædia of the constructive arts, and forms a kind of little library of itself for the mechanic, be he professional or amateur. Mechanical drawing, casting and founding, forging and finishing, soldering, sheet-metal working, carpentry, cabinet-making, carving and fretwork, upholstery, painting, graining, marbling, staining, gilding, polishing, varnishing, the various kinds of mechanical movements, turning, masonry, plastering and whitewashing, roofing, glazing, bell-hanging, gas-fitting, paperhanging, lighting, warming, ventilating, foundations, roads and bridges, water-supply and sanitation, and house construction are treated of in succession; a mere list of some of the leading subjects discussed, which will give a fair idea of the comprehensive nature of the work. To the emigrant, or to any one else thrown on his own resources in the matters on which it treats, the Messrs. Spon's volume must be simply invaluable.

THE value of the storm-signal service in force on the Canadian lakes and throughout the Dominion is shown by the recent report for 1884, wherein it is stated that out of 841 warnings issued, as many as 658 were verified.

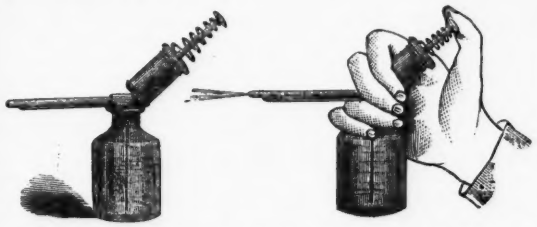
ROYAL VICTORIA HALL, WATERLOO-BRIDGE-ROAD.—On Tuesday, January 13, Professor H. G. Seeley lectured to an appreciative audience, on Ancient British Glaciers. After defining a glacier as a great mass of ice lying high up on a mountain, and saying that there was a time when these islands were covered by huge glaciers, Mr. Seeley explained how glaciers are formed. They are composed of snow which, even in summer, exists in the higher regions of the air, and covers the highest mountains, even in the warmest countries. As you recede from the Equator, the limit of perpetual snow comes lower, being in Norway only 4,000 feet above the sea-level. Some beautiful photographs of snow-flakes were exhibited on the screen, each flake a crystalline star with six points. The lecturer explained that the effect of compressing the snow (as in making a snowball) is to melt the surface of each flake, which on the pressure being removed freezes again into ice. This process Nature is carrying on on a large scale in the Alps. The snow keeps melting and freezing again; the ice thus formed glides slowly down the valley, but with irresistible force, grinding and scratching the rocks underneath, carrying along great masses of rock and a vast amount of smaller fragments, and often cracking with the strain, as it passes over a steep angle, forming huge fissures or crevasses in the ice. This part of the lecture was illustrated by beautiful photographic views of the Swiss glaciers. The lecturer went on to say, that where we find a multitude of huge stones rounded, grooved, or polished, and huge detached rocks far from any others of the same kind, there we may infer ice-action. From these tokens we learn that a huge glacier once extended over a great part of Scotland, the north-west of England, North Wales, and the north of Ireland. At that time the Irish Channel and German Ocean did not exist, England was much more elevated than now, and was united both with Ireland and with Norway. Views of Loch Lomond, Snowdon, Llanberis, &c., were here shown on the screen, and the works of ice-action pointed out. This ice-period was followed by a gradual subsidence of the land, which caused the climate to become milder and the ice to melt away. Another elevation of land ensued, not to the same height as before, but sufficient to produce smaller glaciers in different parts of the country, which again disappear with a renewed subsidence of the land. The audience joined in a hearty vote of thanks to Prof. Seeley. The lecture next Tuesday will be by Mr. Wm. Lant Carpenter, and will be entitled "More about the Sun."

Our Inventors' Column.

So great is the number of inventions now patented that many good things are comparatively lost in the crowd. A succinct account, therefore, by an Expert, of all inventions of really popular interest and utility must be advantageous both to the public and the Inventor, enabling persons to hear of inventions already desiderated by them, and thus acting reciprocally as a stimulant on supply and demand.

SPRAY DISTRIBUTOR.

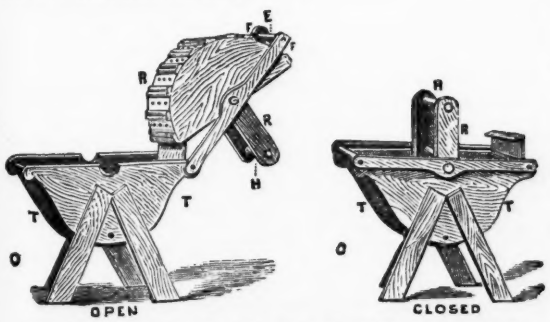
[Patent No. 3405. 1884.]—This is an ingenious and eminently valuable piece of apparatus, patented by Dr. Alfred Wright, who calls it an "Atmonemetor." It consists of a bottle or liquid-holder to which is attached a syringe which is worked by pressure of the thumb on a spiral spring attached round the piston-rod; thus, air being driven down displaces a small portion of the fluid contents of the bottle and forces it along a horizontal tube, at the end of which it is discharged through very minute orifices, and is distributed very finely divided as spray.



The application of remedies in the form of spray in diseases of the throat and respiratory tract is now becoming generally adopted, and this instrument promises to become a great favourite, it being the most convenient spray-producer and distributor yet invented. It is light, and is easily held and worked with one hand. These are very great advantages, especially when applying spray remedies to the throats of children.

WASHING MACHINE.

[Patent No. 1876, 1884.] Among the numerous washing machines before the public the Enchantress, patented by Mr. J. R. Taylor, Kingswinford, is one of the most recent, and in many respects is unique. It has been the object of the inventor to produce a machine that will *wash* any fabric without damaging the material—will wash it better and quicker than any other means, and with less labour and soap.



Considering that the old style of hand-rubbing is as effective a process for cleaning clothing as can well be imagined, he has adopted the same mode of cleansing in his machine, which represents two very large hands, with ribs or wooden rubbers corresponding to the knuckles of the hand.

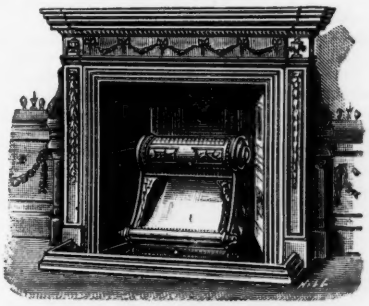
Reference to the "open" cut shows the machine ready to receive the water, clothes, &c., and it will be seen that the rocker (R) on its semi-circular face is fitted with grooved fingers, and so acts as one hand. The inside of the tub (T) is fitted with similar fingers, which oppose those of the rocker when in place for business, and so constitutes the other hand. When the rocker is in position, the axles fall into the notches visible in top edges of open tub, and then the machine has the appearance indicated in the second figure.

To use the machine, the operator, having soaped in the clothes, placed sufficient water and the clothes in the tub, and closed down the rocker, stands at the "O" end of machine, and, grasping the handle (H) with one or both hands, works the rocker to and fro, thereby giving the necessary friction, and in a very *few seconds* all the articles in the machine are made perfectly clean.

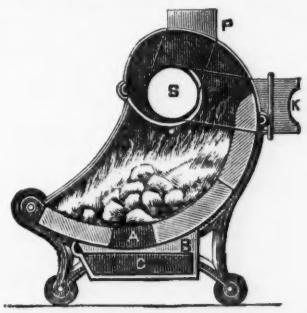
The Enchantress is made of wood and zinc, without any iron-work to injure or rust the fabrics, nor has it a cog-wheel about it, and it is capable of doing a large amount of work efficiently.

THE "NAUTILUS" FIRE-GRATE.

[Patented, 1884.]—Mr. J. B. Petter, of Yeovil, Somerset, has patented a new grate, which he has called the "Nautilus," and which possesses many interesting features to recommend it. As



may be gathered from the accompanying illustrations, it is a fire-brick lined slow-combustion dog-stove, in form resembling a Nautilus-shell, burning ordinary coals. In all its various forms, the smoke revolves within the centre or axis, before passing off through the exit nozzles, S, K, or P, into the small flues leading to the chimney. Provision is made for regulating the draught to the greatest nicety, whereby the fuel consumption is marvellously small. The smoke is claimed to be automatically consumed by being drawn over or through the incandescent fuel at the back of the fire. Heat is radiated directly from a bright and glowing open fire, and indirectly from its outer case. A register door (for sweeping) encloses the chimney immediately over the grate, thus obviating any waste of heat. The ash falls through the grating A into the concealed ash-pan C, thus allowing no dust to fall upon the hearth, and ensuring great safety and perfect cleanliness.



The grate may be fitted in any fire-place, and, being on wheels, may be removed in the summer, and its place filled with ferns or flowering-plants. The fire may be laid in and lighted in the same manner as that of an ordinary register grate.

DR. BOND'S PATENT MILK-TESTER.

THIS very cheap and simple piece of apparatus for making a rapid approximative determination to the percentage of butter fat contained in any given sample of milk, consists of a glass vessel, at the bottom of which fine parallel black lines are ruled in a circle, an ounce measure, and a glass dropping-tube with an india-rubber capsule. It is used by pouring a measured ounce of water into the glass vessel and then adding to it the milk to be tested (by means of the dropping-tube) until the lines at the bottom of the glass dish just cease to be visible. The number of drops of milk needful to cause their disappearance is counted, and then a table (which is stuck on the lid of the box containing the whole apparatus) gives the percentage of butter fat contained in the sample of milk experimented on. Dr. Bond's ingenious device has been brought out by the Sanitary and Economic Association, Gloucester.

"Let Knowledge grow from more to more."—Alfred Tennyson.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the Editor of Knowledge; *all Business communications to the* Publishers, *at the Office, 74, Great Queen-street, W.C.* If this is not attended to delays arise for which the Editor is not responsible.

All Remittances, Cheques, and Post Office Orders should be made payable to Messrs. Wyman & Sons.

The Editor is not responsible for the opinions of correspondents.

No communications are answered by post, even though stamped and directed envelope be enclosed.

THE DUALITY OF THE BRAIN.

[1565]—The case of Sergeant F. is extremely interesting. But (page 22, col. 2, lines 3 to 6) how, may I ask, "in the absence of impressions derived from the sense of sight," and, "guided entirely by the sense of touch," did he gain "the consciousness of the existence" of the screen interposed between his eyes and his hands?

Perhaps, however, the circumstance of the screen is not quite fully described. The "sense of touch" theory seems shaken somewhat by the fact that, while it was sufficiently delicate to detect a difference between ink and water in the pen, it was unable to distinguish between a walking-stick and a fire-arm.

Whether by touch, or by sight, or however he acts, the theory seems a reasonable one, that, in his abnormal state, he is a mere automaton, his actions being only repetitions of experiences he had before his accident.

I have myself experienced some of the peculiarities of "duality" which you have so carefully described.

There is one condition of mind which causes me inconvenience. I have fairly good powers of concentration, and can grasp a subject quickly and completely. But the next subject I take up seems to expel the old one, which requires almost as much application and study, as before, *over again* to recover. My sermons of three months ago have entirely escaped me. Do you think that the Loisettian system would help me to retain them, or recover them with less effort?

Let me conclude by wishing you every success during the current year. G. M. L.

PREHISTORIC SEPULTURE.

[1566]—Your correspondent "Hallyards" (letter 1556) is very likely right in his surmise that there are cromlechs which were originally constructed for habitation, but the following is an instance of "early men" going to "immense labour for the dead" alone which may interest your readers.

In a neighbouring large woodland, at the edge of a deep-timbered valley, a few weeks ago I observed a slight rise in the ground, passed many times before during my life unnoticed. Accidentally walking on to its summit, a complete circular form struck me at once as artificial, and as being probably the site of an ancient interment.

On the 24th of December last the mound was opened. It measured 34 ft. in diameter, and was found to consist entirely of rough stones of various sizes from the oolitic rocks of the adjoining valley. The layer of stones increased in thickness from a few inches at the edge to over two feet at the centre of the mound, where, and towards the bottom, were many large slabs, some two feet in length by twelve or fifteen inches broad. Some of the stones had been jammed in edgewise.

At the centre of the mound, about a foot from the surface, and lying meridianally with the head to the south, were the remains of one large male skeleton. Unfortunately, exactly over it a stunted birch-tree had grown, whose roots had penetrated the stony covering, thereby admitting the rain and frost; otherwise the skeleton would probably have been much more perfect than it was. From the concentration of the bones, I think the body must have originally been laid in a crouching position. The bones of the skull recovered are of great thickness, and the crowns of the teeth, in which there is not a trace of decay, are worn down quite smooth. I enclose an impression in sealing-wax of one of them.

Close by the bones, and on the west side, were the fragments of a rude, brown, earthen vessel, much decayed, being of soft, imperfectly burned clay. It had been ornamented in bands, and rough tool-marks in panels—a "rubbing" of one of which I send you. Near by was a small disc, also of soft earthenware, measuring 1¼ in. in diameter, by ¼ in. thick. It is roughly rounded, and somewhat resembles an old-fashioned halfpenny. Can a primitive race have thus endeavoured to imitate a coin they had seen in the hands of a more civilised people with whom they had come in contact?

No flint or metal implements of any kind were unearthed, but as many flint flakes, and I believe some arrow-heads, have been picked up on the adjoining farm, where other barrows of a similar kind were formerly opened, I conclude this interment belonged to a neolithic race.

I may add that the nearest source of supply of flints is the chalk wolds twenty miles away on the other side of the Vale of Pickering.

In this burial we have an example of a rude tribe laboriously quarrying some hundred tons of stones from a steep hillside, and carrying them to the top, simply to form the tomb of one of their revered dead.—Yours obediently, Kirkdale Cave.

ELECTRO-PLATING.

[1567]—In No. 166 of Knowledge, in his article on electro-plating, Mr. Slingo states that the work after having been plated should be dried out and then scratch-brushed to remove the dead surface. This is a mistake. The work should be scratch-brushed before drying, as water must be freely used with the scratch-brush, otherwise the work would be "scratched" in reality, either by the wires of the brush or the bath brick whichever may be used. For work that is not to be burnished, silver sand is preferable to bath-brick, as it leaves a brighter appearance.

In the event of the work stripping, if only to a slight extent, the replating of it may sometimes be avoided by what is known as "doctoring" it. To do this, the part where it has stripped should be made smooth and level with a piece of fine emery paper, and then rubbed with a little wet sand and quicked. A small piece of silver, wrapped in a rag, should be connected with the positive pole of the battery, dipped for a moment in the silver solution to saturate the rag, and then applied to the defective portion of the article, which must be connected with the negative pole. A few minutes will suffice to coat it sufficiently to be burnished.

A. J. Wright.

[I find it preferable to dry the article prior to applying the scratch-brush, which, it must be remembered, I use in conjunction with stale beer, whereby scratching is prevented.—W. S.]

AN EARTHQUAKE IN ENGLAND.

[1568]—Seeing that in your "Gossip" of this week you hint at the probability of vibrations from the late earthquake in Spain being felt in England, I think it may interest you to know that one night last week at 11.30, and again on the 6th at 10.30 p.m., my sister and myself both felt several light shocks (unaccompanied by a rumbling sound), which, though unperceived by my servants, were distinctly felt by us, who have several times experienced earthquakes in Switzerland. The shocks on the 6th lasted some seconds. We live in a retired part of Worthing.

L. Michaud (de la Sarraz).

BANKRUPTCIES IN 1884.

[1569]—It is a very popular error to suppose that there are more bankruptcies when trade is bad than in times of prosperity. It is just the reverse. The more trade the greater the speculation, and the more there are to speculate; hence more bankruptcies, which are the result of speculation. If the new Act has been designed to prevent debtors and creditors availing themselves of it, it has succeeded admirably. No person with ordinary means can have anything to do with it. It is, therefore, useless to debtors and creditors alike. No one (volunteers included) will work under it if they can get a chance to settle without it, so that it is no statistic except to show how thoroughly it is a failure. Many debtors are now still debtors because their creditors are too poor to put a petition on the file. Had the writer of the note read any of the articles in the daily or law papers, he would never had written in praise of such a futile act. John Alex. Ollard.

SOCIETY FOR PSYCHICAL RESEARCH.

[1570]—For some time past a committee of the Society for Psychical Research have been engaged in collecting cases where the death (or some serious crisis in the life) of one person has apparently produced a distinct impression, either of sight or sound, or of more purely emotional sort, on the mind of some other person at a distance. The first-hand evidence for such instances of spontaneous "telepathy" is much more abundant than was at all generally recognised when we begun our work. But in a subject so remote from exact science, and specially exposed to dangers of exaggerative memory and erroneous inference, it may reasonably be demanded not only that the quality of the evidence shall be as good as possible, but that its quantity shall be overwhelming. The proof must be largely cumulative, and it is impossible to lay down any precise line at which it can be said that a fair mind ought to be convinced. Moreover, as facts multiply they shed light on one another; a hundred cases are far more instructive than twenty, and a thousand than a hundred. On every ground, then, we are anxious to increase our store of first-class evidence on this head; and we hope that many of your readers may be able and willing to help us, either by communicating personal experiences, or by making our object known among their friends. I need hardly add that any conditions which informants may attach to their communications will be carefully observed.

Another necessary branch of our work is to discover what proportion of the population has experienced purely subjective hallucinations—have seen the figure of an absent friend, or heard his voice, without the correspondence of any marked event in the life of the person whose presence was thus suggested. Till this proportion is approximately ascertained, it cannot be known how far the correspondences in other cases may be accounted for as due to chance alone. Here, then, we have to institute a sort of census, for which many collectors are required. Help in this direction is easily given, and is specially useful. To those who offer it I shall be happy to supply the necessary instructions and printed forms to facilitate the work.

Information in the various other branches of the Society's work will also be welcome. In particular I may mention a kind of evidence which there is reason to think that a considerable number of the households of this country might be able to contribute, if only the trial were made—records of experiments in thought-transference proper, the *bonâ-fide* transmission of ideas or sensations from one person to another without contact or movement. Printed forms for such records will also be supplied to those who desire them.

EDMUND GURNEY.

A SPIRITED APPEAL.

[1571]—To all and several whom it may concern. What are the Mediums, Clairvoyants, Thought-readers, *et id genus omne* in familiar intercourse with the "Spcerits" about that they do not now come to the fore and show their muscles? Would they but call up the "Speerit" of that famed old Bow-street-Runner Townsend, and get "it" to point out the dynamiters, I will answer for it they would sell a fine lot of high-priced tickets for their next *séance*.

J. M.

LETTERS RECEIVED AND SHORT ANSWERS.

J. A. L. B. Because it is practically impossible to pull with precisely equal degrees of strength with both hands simultaneously. If you find that, at the first trial you have pulled off the left hand piece of the three; on the second, you naturally direct your attention to the right hand bit; and, all unconsciously, you pull more strongly with the right hand, employing the left rather to resist. Lectures unfortunately permanently at an end.—F. LANKESTER. It arrived just too late for insertion this week.—THOS. J. SAVAGE. I wholly fail to see the force of your argument. No substantial alteration can now take place in the Queen's profile during the next fifteen years, and it will be ample time to discuss any change necessary when there is a new issue of stamps. That, because a comparatively slight alteration in a lady's features may occur between the ages of sixty-six and seventy-six, she should therefore continue to be represented as eighteen years old at the former age, *may* be a logical deduction; but, as I have said, I absolutely fail to see it. Your suggestion that the money value of every stamp should be very boldly inpressed upon its surface appears to me much more sensible and practical.—IGNORANCE. It would render a reply to your query considerably easier were you to state exactly from what soil, stratum, or deposit you "exhumed an old oak," because a tree deeply immersed in bog would presumably be older than one but slightly covered with alluvium. As Sir Charles Lyell predicates the existence of man on the earth for at least 100,000 years (and this is probably a considerable understatement of human antiquity), there would be nothing wonderful in a semi-barbarous hunter shooting his flint-tipped arrow only 16,000 years since.—F. As it happened I did not see the paper to which you refer until it was in print, it having been reproduced verbatim from an American journal. Of course I know that Tilgate Forest, the scene of Gideon Mantell's imperishable labours, is in Sussex, but an American author would probably be rather more ignorant of British geography.—ALFRED SARGEANT. Received; but (I must reiterate) foreign to the purpose of a journal devoted to science.—C. H THOMPSON. See paragraph in capital letters with which the heading of the Correspondence column concludes.—SIGMA inquires for chemical means of sweetening rancid butter.—A. H. MAYS. Quite needlessly delayed through being addressed to the Editor instead of to the Publishers. JAS. W. FRASER. How can you expect me to occupy space with such a mere puzzle? It is quite equivalent to the old Cambridge one of the man with the absolutely spherical head, surmounted by a conical cap of infinite height.—Rev. J. M. BRACKENBURY. Your letter is a profound puzzle to me. I am assured by "F. R. A. S." that he described the anorthoscope from one constructed entirely by his own hands; in fact, he has shown me the instrument itself, in which the semblance of a hand of cards and of a grotesque head were exhibited in succession in a very striking manner. I do not know whether any optician now sells this piece of apparatus. Can any correspondent say?—P. J. POWER. Yes. See concluding paragraph in capital letters of those which head the Correspondence columns.—H. W. T. You ask for what no single book with which I am familiar contains. One that did would sell like wildfire.—J. H. ROBERTSON. The paragraph you quote is curiously misleading. *Superincumbent pressure* might increase the density of water enormously; but, as you probably know, with regard to a body within a sphere, the attraction of gravitation is only that of the sphere upon which the attracted body rests; the attractive forces of any exterior spherical shell being practically negligible—in fact, in one sense, exercised in a contrary direction. A body in the centre of the earth would be released from gravitation, and have no tendency to move one way or the other. You will find that all our regular staff of contributors do give the explanation of the technical terms they employ. Thanks for good wishes.—JOS. W. ALEXANDER. The æther is certainly *not* a fluid, homogeneous or otherwise; in fact, its properties are of the most extraordinarily opposed natures. Physicists do not now regard the æther as "a comet retarder." Encke's is the only comet out of the large number known which gives any indication of possible retardation from this cause. By all means try a Krakatoa at the north pole. Neither the time of rotation of Uranus, nor that of Neptune, is definitely known.—J. E. SAUNDERS. Such tumuli are very far indeed from being uncommon.—H. TOMKYS.—Your idea of communicating electrically with the inhabitants (if any) of the other planets—presumably by the action of light or selenium—is a very grand and gorgeous one; but do you imagine that English is spoken in (say) Mercury, or that electrical knowledge is in an advanced state in Mars?—SCORPIO. I can understand your difficulty arising in the Arctic regions where there are six months day and six months night; but I confess that (save under circumstances which would appal Sir Wilfrid Lawson) I should think that mere daylight would prevent any one from confusing 2 a.m. with 14 h. or (as most people say at present) 2 p.m.—T. A. K. The "Cambridge University Calendar" is published by Deighton, Bell & Co., at Cambridge, and costs 6s. 6d. Information as to the cost of living, &c., up at the University, may be obtained from "Our Sons: How to Start Them in Life," by Arthur King, published by F. Warne & Co. I forget the price of this, but it is a cheap book—half-a-crown or so.—WM. HODSON. I neither can nor will do more sums, or solve equations whose solution may be found in every shilling book on Algebra ever published; 3·75 days is the answer. I do not believe that there is any work extant for teaching writing with the left hand.—J. S. G. The articles on "Learning to Swim" appeared in Vol. II. of KNOWLEDGE, pp. 179, 212, and 308.—G. F. PICTON. The conductor of this journal has never written one single line of the (alleged) "Correspondence between Dr. Groth and Mr. R. A. Proctor."

TO DISTINGUISH BUTTERINE.—The following simple method has been suggested for approximately judging of the purity of a specimen of butter. Melt the butter, and then cool it as rapidly as possible by means of some ice-cylinder put into it. Lard, which is a copious constituent of butterine, will sink to the bottom, and any genuine butter present will rise, while there will be a distinctly visible zone or line of contact between the two.—*American Druggist.*

XUM

Our Whist Column.

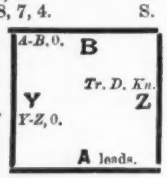
By Five of Clubs.

THE following game, sent us by Mr. Proctor (Mr. and Mrs. Proctor were *A* and *B* respectively), illustrates well the negative use of the Whist signals. Note how *Y*'s *non*-echo enables *A* to place first three and afterwards a fourth trump in his partner's hands.

The Hands.

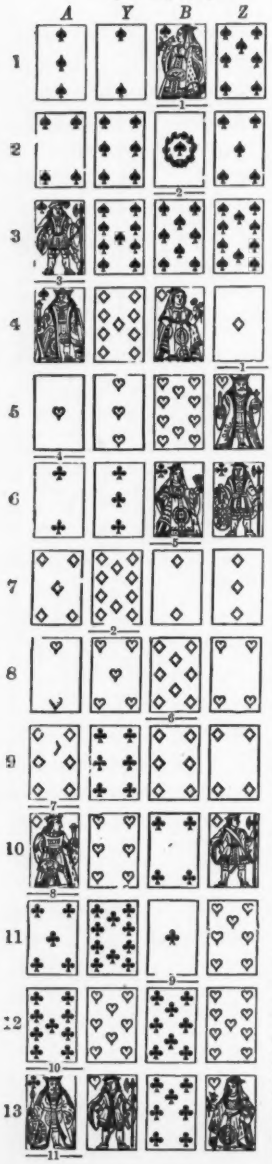
B { *D.* Q, 8, 6, 2. / *C.* A, Q, 8, 7, 4. } H. 10. / S. A, Q, 8.

Y { *D.* 10, 9. / *C.* 10, 6, 3. / H. Kn, 8, 6, 5, 3. / S. 9, 6, 2. }



Z { *D.* 3, 4, Kn, A. / Kn. C. / H. 4, 7, 9, Q, K. / S. 5, 7, 10. }

A { *D.* K, 7, 5. / *C.* K, 9, 5, 2. } H. A, 2. / S. K, Kn, 4, 3.



THE PLAY.

Card underlined leads first.

1. *A*'s lead of the Three and the fall of the Two from *Y*, show that *A* has not more than three Spades left; for if he had originally held five he would have led the penultimate. *Y* is not signalling and therefore has not commanding strength in trumps.

2. *Z* has signalled. Either *Y* has no more Spades or he is not echoing; for he can hold no Spade below the Six. *B* should have shown his suit before playing out the Spade Ace; but he is one of those who object to leading from a suit headed by a major tenace.

3. *Y* has not echoed; he therefore has not more than three trumps.

4. *A* plays the thirteenth Spade to force the adverse strong trump hand. *Y* does his best to save his partner's trumps. Again he has the chance of echoing, by playing Ten before Nine; but his second negative is not completed till trick 7.

5. As *Z* does not lead trumps, *A* can safely infer that he had signalled from four trumps only (two honours). Therefore as *Y* does not hold three more trumps, *B* has two more at least. *A* also sees that *Y-Z* hold all the remaining Heart strength.

6. *A* might have forced his partner in Hearts here, or secured a trick in Hearts if *B* should have the Knave. But it is better to try the Club suit, which is probably *B*'s, before thus playing a defensive game. If *B* has strength in Clubs *A-B* may make a great game.

7. Well played both by *B* and *A*. *B* seeing that *Z* has not led trumps when he could, leads through him. *A* does not take the trick, because by leaving it he remains with the major tenace and hopes to be led up to. Observe that the knowledge gained from Y's not echoing, enables *A* to count the trumps. It had already showed him that *B* had at least two more trumps after trick 4, and *B*'s lead of the Two, combined with this knowledge, shows that *B* has yet another trump. For had he held only two he would not have led the lowest. *Y* therefore can have but one more — probably the Ten. *Z* certainly does not hold the Ten (observe the trump card). *A-B* can lose nothing and are very likely to gain by passing the trick.

8. Again well played by *B*. Had *B* trumped with the Six, *Z* could have dropped Four to the lead of Eight, and as *A* could not then have cleared out trumps, *Y-Z* would have saved the game by a ruff. *Y* ought to have foreseen the danger lying in wait for *Y-Z* and saved the game by a Club lead.

9. As it is, *A* makes his trump Seven, and knowing the Ace of Clubs must be with *B* (or *Y* would have led it), draws *Z*'s trump Knave, and

11, 12, 13. The rest of the game plays itself. *A-B* make five by cards.

More Light and Purer Air.—From a social point of view, it is almost impossible to over-estimate the nuisance that arises from the failure of science to solve the problem of complete combustion. Habit has accustomed the inhabitants of our large manufacturing cities to an amount of dirt and inconvenience which materially interferes with the common amenities of existence. The elements which all mankind—and, in fact, the whole animal kingdom—ought to enjoy as their birthright are denied to the wealthiest inhabitant of a manufacturing town. The light is obscured and the atmosphere polluted to an extent that accounts for many of the worst features of our social life. Among the labouring classes a winter spent in a large industrial centre is often a more trying ordeal, in all its essential elements, than banishment to the wildest and the most inhospitable regions of nature. Rising in darkness that is frequently rendered more obscure by smoke and exhalations, they return at night to breathe the same perpetual foulness. The conditions which produce lassitude among the educated and the wealthy, rendering change of air a necessity, cannot be supposed to leave those who are more constantly subjected to their influence unaffected by their continual presence. It seems unreasonable to expect that the prescriptions of the physician for the better classes, in the form of tonics, should not find their counterpart among the working classes in the shape of stimulants, with all their concomitant evils of drunkenness and crime. One may safely say that the moral effects of this failure of science to solve the problem of complete combustion are to be estimated as a great national calamity. The physical results are even more apparent. The labour necessary to combat with the dirt arising from the smoke of a great city must of itself be equal to any one of its largest industries. Unfortunately, this labour falls to the share of those who are already over-burdened. It too often overpowers the exertions of the workman's wife, who at last gives up the contest, and contents herself with the constant contact of squalor. Let any one estimate for himself the money value represented by the labour necessary to clean the windows, and sweep the chimneys, and beat the carpets, and wash the extra linen of such a city as Manchester, and he will then discover the social importance of complete combustion.—*Great Industries of Great Britain* for January.

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